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ABSTRACT

The general features of function-specific assessment are described and illustrated via a discussion of the design and development of "The Reading Biographer," an instrument for assessing experiences and activities of students (from early childhood through high school) that affect their reading achievement as high school seniors. The instrument was developed as part of the model of function-specific assessment, and it is designed to fulfill a well-defined assessment purpose and to define the expected relationships. The Reading Biographer consists of items representative of individual home, school, and extracurricular experiences that have been linked empirically to the reading achievement of students at preschool, elementary school, and high school levels. The instrument, developed and field tested over 2 years, was used to collect data from approximately 4,000 high school seniors in 24 school districts. A longitudinally based multiple regression model was computed from analyses of the relationships between the selected variables and reading achievement. All nine predictor variables showed a relationship to the reading achievement of high school seniors. One of the most predictive variables was the measure of preschool home educational experiences. Results indicate that functional assessment provides a viable solution to many current problems in educational testing and evaluation. Five tables and four figures contain study data. (SLD)

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DESIGN AND DEVELOPMENT OF THE READING BIOGRAPHER: AN APPLICATION OF FUNCTION SPECIFIC ASSESSMENT[1]

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Although norm-referenced achievement tests traditionally employed by schools to measure students' skills and abilities are still widely used, they have been criticized as largely atheoretical (Anderson, 1972; Curtis and Glasser, 1983; Daneman, 1982) and as being insensitive to schooling effects. As a result, it has been difficult to find the expected relationships of school "inputs" to school "outputs" (Hanson and Schutz, 1978). This is due to the well-documented sensitivity of norm-referenced tests to social class/home environmental factors rather than to educational programs and other schooling factors. One way to begin to resolve this situation is to obtain information about the broad range of factors known to influence the achievement of students throughout development. The purpose of this paper is to: (1) describe an effort to assess the major factors related to the development of reading skills of young adults using function specific assessment methodology (Hanson and McMorris, 1986) and (2) to document the application of this methodology to the development of the *The Reading Biographer*. The general features of function specific methodology are described and illustrated in the design and development of *The Reading Biographer*. This instrument was the product of a systematic effort to identify and validate particular experiences and activities of students, from early childhood through high school, that affect their reading achievement as high school seniors. It was developed as part of The

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Kindergarten Follow-up Study (KFS) which evaluated the long-term effects of learning to read in kindergarten (See Hanson and Siegel, 1988). *The Reading Biographer* was developed and field tested over a period of two years and used to collect data from approximately 4,000 high school seniors in 24 school districts across the United States (Hanson and Siegel, 1988). Selected data which bear on the validity and utility of the information it provides are also reported. These were taken from Siegel (1987).

Function-Specific Methodology

The design of *The Reading Biographer* utilizes an emerging model of instrument development referred to as function specific assessment (Hanson & McMorris, 1986). In this approach, the assessment instrument is developed as part of a model, or system, designed to fulfill a well defined assessment purpose and to define the expected relationships. Because these relationships are expected to emerge each time the instrument is utilized, validation becomes a contineous and ongoing process.

In contrast to domain-referenced and norm-referenced approaches to instrument development, design specifications for function specific assessment are critical. The situation and context in which the instrument will be used are both well defined; hence the assessment instrument must be constructed to match these exact specification criteria. This approach begins with detailed analytical work to identify conceptually the situation, populations, and functions of the construct to be assessed. These parameters then become the basis for developing an assessment blueprint to generate prototype items. In other words, the items contained in the instrument measure only those factors which are conceptually related to the construct to be assessed. Thus, the instrument is precisely tailored to the specific key decisions which need to be made.

Once the model has been defined and a blueprint developed, the next step involves generating a set of operationally defined items. The goal of this process is to create behaviorally based items with specific, predefined scoring criteria. Individual items are then aggregated, or clustered together, to create the actual decision variables; a process which enhances the reliability of each decision variable. These variables are then used to evaluate model relationships and to validate the instrument in the applied or functional setting.

After the instrument has been constructed, it is field tested several times in real settings with samples of the targeted population in the actual context of operational use. After each field test, the instrument is reviewed for adherence to specification requirements. Information from these pilot studies provides critical feed-back on specific short-comings, especially on individual items. The results are then utilized to improve the quality of the instrument. For example, information is typically required to acknowledge certain technical aspects of the instrument, such as whether the items adequately represent the variables or if the response scales provide sufficient discrimination. In addition, it is important to confirm logistical procedures, such as whether the time allotment is suitable or if the scoring procedure is operative. Pilot studies also provide a means to obtain general editing comments for clarification purposes and to confirm item appropriateness for the target population. After the necessary adjustments have been made, the instrument is ready for use and validation.

The validation process for function specific instruments has several unique and important features. First, it is driven by a model that specifies precisely the relationships that should emerge, both within assessment variables and to other variables defined by the context of use. In traditional test development jargon, such an approach is alien to the definition of construct validation. Secondly, validation for function specific instruments is ongoing and continual. Each time the

instrument is used, the other operational (model) variables are usually available as well. Collectively, they provide the full set of model variables which are used to examine (and re-examine) the validity of the instrument. For example, should the expected relationships not occur, this would indicate that, for some reason, the instrument was not valid in that situation with that particular group. Such an approach is consistent with the information system approach to educational assessment and evaluation emerging in the evaluation literature (see Hanson, 1985 for a discussion).

Several examples of function specific assessment can be found in a number of key areas previously dominated by the traditional approaches to testing. Among these are testing in the context of instructional programs (Hanson & Bailey, 1985) and certification and credentialing examination development (D'Costa, 1986). Finally, there is considerable support for the general notion and role of function specific assessment in the earlier testing literature (e.g., Travers, 1951; Bloom, 1968).

Although this kind of assessment is not generally employed in schools, they are a logical arena for its use. The success of this kind of testing has been documented in several national studies involving a kindergarten reading program (e.g., Hanson & Schutz, 1978). Using this methodology, instruments could be constructed that would provide information on specific kinds of decisions school personnel require for selecting, implementing, monitoring, and adapting programs. Such instruments would also result in "fair" student, teacher, and program evaluations as they would directly reference the instruction pupils receive.

Description of *The Reading Biographer*

The Student Booklet is a fifteen page pamphlet composed of three parts and developed specifically for a national follow-up study of a kindergarten reading

program (Hanson, et al., 1986). The purpose of this study was to evaluate the effects of learning to read in kindergarten. Accordingly, an instrument was needed to assess the major factors influencing the development of reading skills across development (i.e., birth to age 18) as well as measures of reading competency for high school seniors. Hence, the first and second parts of the *Student Booklet* contain separate tests of reading and vocabulary; the third part is a questionnaire used to generate variables measuring students' reading habits, reading attitudes, family background, and schooling characteristics. This part is referred to as *The Reading Biographer*.

The Reading Biographer has five major sections. The first three sections correspond to the three educational time periods of preschool, elementary school, and secondary school. Within each of these time periods, a series of questions are presented that pertain to home/family, school, and extracurricular experiences which might be expected to influence the development of student's reading skills. A fourth section of the instrument focuses on the current activities and interests of the student. This section provides additional dependent variables on students' current amount of leisure reading and their degree of interest in and attitudes toward reading. The last section collects standard demographic information. Two of these variables, gender and social class, were included in the validation model developed for the instrument.

Development of *The Reading Biographer*

A review of the literature, which included national studies of general achievement as well as those pertaining only to reading, identified factors related to the reading achievement of students at the preschool, elementary and secondary school levels, in the areas of home, school, and extracurricular (e.g., clubs, sports, and part-time jobs) experiences. Operationally defined items were then created to

measure these factors at each of the three schooling levels (i.e., preschool, elementary, and secondary). As a result of this systematic effort, *The Reading Biographer* consists of operationally defined items representative of individual home, school and extracurricular experiences that have been linked empirically to the reading achievement of students at three different schooling levels.

The individual items contained in this instrument can be combined into clusters of home, school, and extracurricular process variables (particular activities and experiences) to measure factors known to affect the reading achievement of students across three stages of development (preschool, elementary, and secondary). A sample of how this procedure was utilized in the instrument validation study is taken from Siegel (1987) and presented in Table 1. This table indicates which items were clustered to create each of the nine predictor variables for reading achievement.

Insert Table 1 here

These nine predictor variables represent five major factors at their respective schooling levels that are potentially related to the reading achievement of high school seniors. The matrix in Figure 1 also indicates which items were aggregated to define each of the nine predictor variables.

Insert Figure 1 here

The items contained in *The Reading Biographer* address clearly identifiable and measurable experiences from early childhood through young adulthood that either had been identified in earlier research, or were logically anticipated to be related to adult reading levels. Figure 2 represents the conceptual framework for *The Reading Biographer*.

Schooling Levels		Reading-related experiences at each schooling level in the indicated area.		
Age	Level	Formal School	Home/ Family	Extra-curricular
0-4	Preschool	X	X	*
5-13	Elementary	X	X	*
14-18	Secondary	X	X	X

*Not measured in this cell.

Figure 2. Conceptual design for The Reading Biographer.

The items generated for *The Reading Biographer* measured the reading-related experiences of students represented by each cell in this design. For example, indicators for the preschool home experiences included six types of parent-child activities and indicators of the preschool formal schooling experiences included six types of formal preschool educational experiences. Respondents indicated, on an ordinal scale, their recollection of how often they participated in these activities. These item responses were then aggregated upwards to form a composite index representing parent-child nurturant interactions and formal schooling experiences, respectively, at the preschool level.

The Student Booklet was refined through a set of three pilot studies; a complete description of this process is provided in the KFS technical report (Hanson, et al., 1986). Based on the results of the three field tests, the final version of *The Reading Biographer* was developed and used to gather data on a total of thirty-two policy variables. The student variables assessed were: (1) demographic characteristics (sex, age, ethnic background); (2) birth order in the family; (3) the age at which the student began to read; (4) activities; (5) student-

owned resources; (6) attitudes toward reading; and (7) reading behaviors. The schooling variables assessed in the final version of *The Reading Biographer* were: (1) elementary school attendance stability; (2) kinds of elementary school programs; (3) elementary school homework; (4) elementary school achievement; (5) secondary school attendance stability; (6) secondary school programs; (7) high school homework; (8) high school achievement; (9) remediation across grades K through twelve. *The Reading Biographer* also assesses the following parent-home based variables: (1) family socio-economic status; (2) primary language spoken in the home; (3) the preschool home environment; (4) rules that the student was expected to follow during his/her elementary years; (5) rules that the student was expected to follow during his/her secondary years; (6) parental involvement in the elementary school years; (7) parental involvement in the secondary school years; and (8) parental reading behavior.

Validating The Reading Biographer

To determine if the variables measured by *The Reading Biographer* were related to the reading achievement of high school seniors as expected, several different analyses were undertaken. First, each variable was evaluated as to its relationship to reading comprehension. Secondly, these relationships were evaluated across social class and gender populations. Since social class has consistently shown a powerful relationship to student achievement (e.g., Coleman, et al., 1966; Jencks, et al., 1972), one of the criteria for validation was that the variables show a relationship to reading achievement within social class populations. This would have powerful educational implications as it would indicate that a particular experience or activity, at a particular schooling level, was related to reading achievement independent of social class background characteristics.

Initially, thirty-two variables were created (e.g., Table 1) from aggregated items in *The Reading Biographer*. Zero-order correlations indicated that at least half of these were related to reading achievement across most social class and gender populations. These thirty-two variables were then aggregated to represent the nine predictor variables for reading achievement (e.g., Figure 1). The correlation of these nine predictor variables with the reading achievement of high school seniors is presented in Table 2. An analysis of variance (ANOVA) indicated that the students' level of involvement (high, moderate, or low), in all nine of these predictor variables was related to their reading achievement as high school seniors. Further, these results generally held up across the social class and gender populations and when the high school, as well as the individual, was used as the unit of analysis. Table 3 and Figure 3 provide a sample of the results of this analysis; these are the results of the ANOVA for the Preschool "Home" predictor variable.

Insert Table 3, Figure 3 here

These results were surprising, particularly in regard to the preschool variables since these variables, although behaviorally defined, could only be general measures of those experiences since they were divorced in time by as much as twelve years.

In a final set of analyses, the nine predictor variables were entered into six regression equations (i.e., overall, male, female, and high , middle, and low social class) in chronological order for the purpose of producing a predictive longitudinal model of reading achievement across social class and gender populations. By examining the significance level and regression coefficients of each variable in the six regression models, it was determined that the variables that contributed to the variance in the overall model, also contributed to to variance in

the social class and gender models. There were, of course, some exceptions and these were discussed in the study (Siegel, 1987). Tables 4 presents the results of the regression model for the overall population and Table 5 gives a summary of the regression coefficients within each gender and social class model.

Insert Tables 4 and 5 here

Results

The development of *The Reading Biographer* provides an important new application of function specific assessment to education. The goal of providing a comprehensive picture of the factors which can be both conceptually and empirically linked to the development of reading competence in young adults was accomplished. The results of the data analyses were used to validate the model of reading competency factors and support this conclusion.

An important factor for the instrument to be considered valid for the study was that the each factor had to show a relationship to the measures of reading competency beyond that due to social class or gender membership alone. In a series of analyses, the relationships between each of the factors derived from aggregated items were evaluated. These analyses included evaluations on an individual basis using zero-order correlations and with multiple units of analysis using analysis of variance. A longitudinally based multiple regression model was computed from the previous analyses and replicated across five subpopulations defined by gender (male/female) and SES (low/middle/high) membership. All nine predictor variables showed a relationship to the reading achievement of high school seniors. Further, these relationships generally held up across social class and gender populations and when the high school, as well as the individual, was used as the unit of analysis.

The regression analysis, which used the norm-referenced reading score of high school seniors as the dependent variable, also provided some important and unexpected results. For example, one of the more predictive long-term variables was the measure of preschool home educational experiences. Conversely, some of the measures of variables closer in time to the dependent variable of high school reading achievement (i.e, elementary schooling experiences) appeared to be less important to reading skill acquisition.

Educational Importance

This paper is of educational importance for several reasons:

1. It presents an alternative methodology to instrument design that provides a viable solution to many of the existing and emerging assessment problems in educational testing and evaluation.
2. It provides an application of the methodology to a complex instrument design task. This application should provide applied guidance to others wishing to use this methodology.
3. It provides a description of a new type of educational measurement tool that should be useful for schools in summative evaluations of their programs in important areas such as reading, science, and mathematics.

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Table 1. AGGREGATION OF THE READING BIOGRAPHER ITEMS TO FACTORS AND PREDICTOR VARIABLES

	Item No.	Item Acornym	Computed Variable	Factors[1] and Pred. Variables
CRITERION VARIABLE:				
1. READING ACHIEVEMENT				
Reading test score	1-20	AIMS1-AIMS20	WRDGSCR	**WRDGSCR**
EFFECTS VARIABLES:				
I. GENERAL CURRICULAR ACTIVITIES				**GEN. CURRIC.**
A. Preschool				**PRESCHOL**
1. Daycare	15 a-b	PSCC, PSCCLOC	DAYCARE	
	12 a	MOMWORK1		
2. Preschool	16 a-c	HDSTART, HDAYPS, ADAYPS	PRESCH	
3. Sunday school	16 f	SUNSCL	SUNSCL	
4. Special Lessons	16 e	SPECLSN	SPECLSN	
				ELSCHOL
B. Elementary School				
1. Days missed	20	ESATTD	ESATTD	
2. homework	22 a-f	ESHMWK1-ESHMWK6	ESHOMWK	
3. Kindergarten BRP	1	KSFK	KFSK	
				HISCHOL
C. High School				
1. Days missed	24	HSATTD	HSATTD	
2. Track	25	TRACK	HSTRAK	
3. Core subjects	26 a-d	ENG9-ENG12, MATH9-MATH12 SCI9-SCI12, LANG9-LANG12	CORESUB	
4. Homework	30 c,d	ACTS3, ACTS4	HSHOMWK	
II. HOME/FAMILY ACTIVITIES				**HOME PSHOME**
A. Preschool				
1. Mom work full time	12 a	MOMWORK1	PSWORK	
2. Quality time	17 a-g	PSSTORY, PSRHYME, PSEDTV, PSPLAY, PSBOOK, PSGAMES	PSQUALTY	
3. English as a second language	8 a-d	LFREQ, LUSE	LANGUAGE	
B. Elementary School				**ESHOME**
1. Mom work full time	12 b	MOMWORK2	ESWORK	
2. Quality time	21 e-k	ESHOME5-ESHOME11	ESQUALTY	
3. Set rules	21 a-d	ESHOME1-ESHOME4	ESRULES	
C. High School				**HSHOME**
1. Set rules	31 a-e, m	HSHOME1-5, 13	HSRULES	
2. Quality time	31 h, i, j, l, n, f	HSHOME8, 9, 10, 12 HSHOME14, 6	HSQUALTY	
3. Mom work full time	12 c	MOMWORK3	HSWORK	
4. Expectations	34	PEDEXP	PEDEXP	
III. REMEDIAL ACTIVITIES				**RETARD**
1. Held back, Elem School	11 a	HOLDK-HOLD6	ESHOLD	
2. Heldback, Hi school	11 a	HOLD7-HOLD11	SSHOLD	
3. Remediation	11 b-e	SUMSCL, REMRDG, RMSPCH, REMENG	REMEDIAL	
4. Suspended	11 g	SUSP	SUSP	
IV. EXCELLING ACTIVITIES				**EXCELLING**
1. Elem sch skip grade	11 i	SKIPK-SKIP6	GRSKIP	
2. Hi Sch skip grade	11 i	SKIP7-SKIP11	SSKIP	
3. Organized activities	30 a, b, e, f, g, h	ACTS1, ACTS2, ACTS5 ACTS6, ACTS7, ACTS8	ORGACT	
4. Honors classes	11 h	HONORS	HONORS	
V. OPTIONAL ACTIVITIES				**OPTIONAL**
1. Unorganized activities	30 i, j, q, r	ACTS9, ACTS10, ACTS17, ACTS18	UNORGACT	
2. Hobbies	30 k, l s, t	ACTS11, ACTS12 ACTS19, ACTS20	HOBBY	
3. Jobs	30 m, n, o, p	ACTS13, ACTS14 ACTS15, ACTS16	JOBS	

[1] Factors are in bold; the other variables represent the factor at particular schooling levels.
Biosocial Variables: Social Class (POP) and Gender (SEX)

Matrix of reading achievement factors with *The Reading Biographer* items comprising each factor at each schooling level.

School Levels	HOME Male L M H Female L M H	GEN. CURRICULAR Male L M H Female L M H	REMEDIAL Male L M H Female L M H	EXCELLING Male L M H Female L M H	OPTIONAL Male L M H Female L M H
Pre-School (0-4)	Mom worked: 12 A Quality Time: 17 English as a Second Language: 8 A-D	Preschool: 16 A-C Daycare: 15 A,B 12 A Special Lessons: 16 E Sun. School: 16 F			
Elem. School (Grade: K-6)	Mom worked: 12 B Quality Time: E-K, L, M Home Rules: 31 A-D	Homework: 22 A-F 30 C-D Kindergarten Read Program: 1 C Days Absent: 20	Held Back Elem.: 11 A Remedial Classes: 11 B-E	Skipped Grade Elem.: 11 I	
Second. School (Grade: 7-12)	Mom worked: 12 C Quality Time: 31 F,H,I,J Home Rules: 31 A-E,H Parents' Educ. Expectations: 34	Homework: 32 L-F Hi Sch. Curric Track: 25 Core Subjects: 26 A-D Days Absent: 24	Held Back in HiSch.: 11 A Suspended: 11 G	Skipped Grade HiSch.: 11 I Honors/Gifted Classes: 11 H Organized Extracur: Activities: 30 A,B,E,F,G,H	Unorganized Extra-Curricular Activities: 30 I,J,Q,R Jobs: 30 M-P Hobbies: 30 K,L,S,T

Figure 1.

Table 3. Correlation[1] of predictor variables, SES, and Gender with reading achievement[2] and ranked from high to low by Pearson Zero-Order correlation coefficients.

Predictor Variables	Reading Achievement (NRDGSCR)
Secondary General Curricular Experiences	.3262**
Elem. & Secondary Remedial Experiences	-.2417**
Elem. & Secondary Excelling Experiences	.2183**
Secondary Home Experiences	.2140**
Secondary Discretionary Experiences	-.1920**
Preschool Home Experiences	.1552**
Elementary General Curricular Experiences	.1475**
Preschool General Curricular Experiences	.0932**
Elementary School Home Experiences	.0759**
Social Economic Class	.0678**
Gender	-.0136

1 **p<.001
2 Normalized scores on the AIMS reading test in *The Reading Biographer*.

Table 3. Summary of mean reading scores in each "Preschool" Home predictor variable category with Reading Achievement as the criterion variable.

"Preschool" Home Categories (PSHOME)	Social Class Low Male	Low Female	Middle Male	Middle Female	High Male	High Female	Overall Mean Score*
Low Parental Involvement with Student during Presch.	13.4 n=253	13.4 n=153	13.2 n=144	13.8 n=77	14.6 n=23	14.0 n=12	13.5 n=662
Moderate Parental Involvement with Student during Presch.	14.2 n=291	14.1 n=224	14.6 n=175	14.5 n=150	17.1 n=36	16.4 n=25	14.3 n=921
High Parental Involvement with Student during Presch.	15.3 n=117	15.4 n=197	15.0 n=71	14.6 n=131	15.9 n=29	15.9 n=44	15.2 n=589

* ANOVA Significance level for the three "Preschool" Home comparison groups: $p<.001$

Items included in this predictor variable measured the following preschool home experiences:

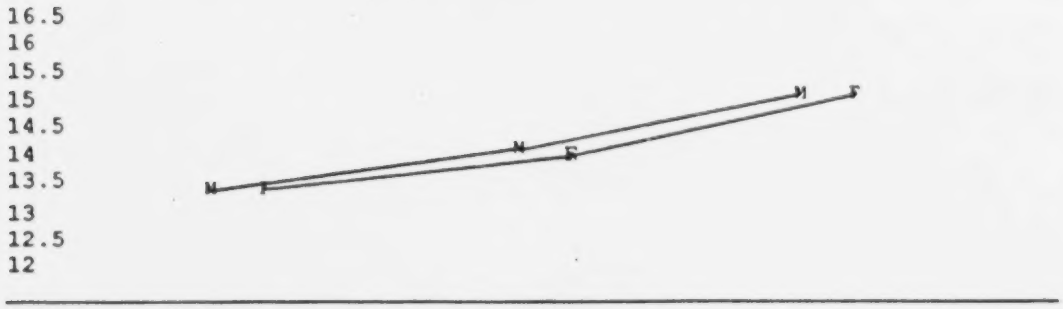
1. Whether or not the mother worked full-time while the student was in preschool.

2. Whether or not English was spoken as a second language in the home.

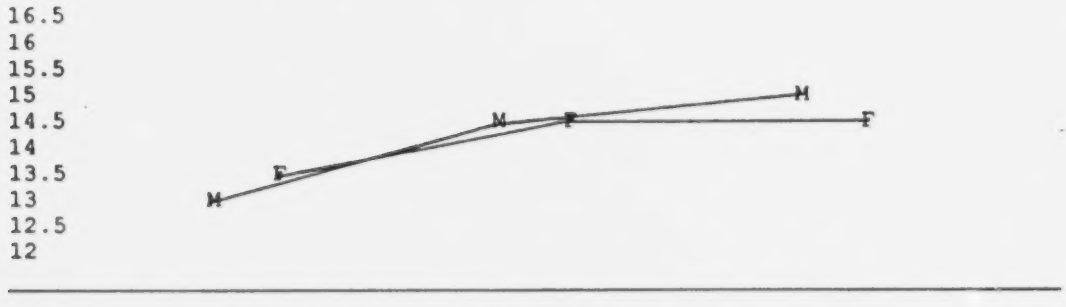
3. The general frequency (rarely, sometimes, regularly) of specific reading-related activities that parents encouraged or taught their students before the child entered kindergarten. For example:

   A) Read bedtime stories
   B) Learn nursery rhymes and stories
   C) Play with coloring books and crayons
   D) Play word or number games

MEAN READING SCORES OF LOW SES STUDENTS IN EACH "PRESCHOOL" HOME CATEGORY



MEAN READING SCORES OF MIDDLE SES STUDENTS IN EACH "PRESCHOOL" HOME CATEGORY



MEAN READING SCORES OF HIGH SES STUDENTS IN EACH "PRESCHOOL" HOME CATEGORY

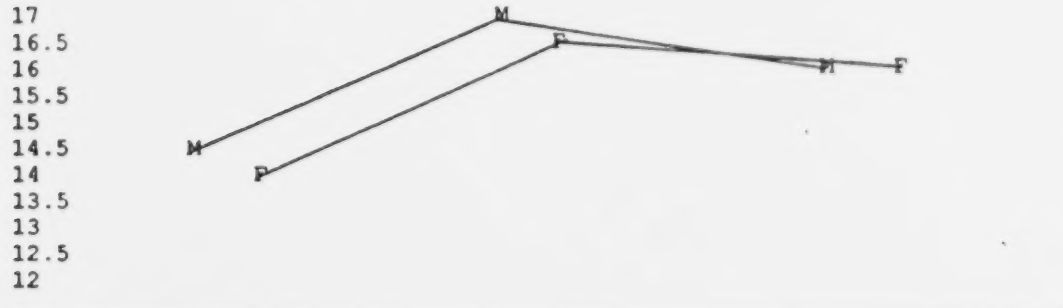


Figure 3 ... Graphs of "Preschool" Home mean reading scores by social class and gender populations.

Table 4. Summary of the regression model for the entire sample with Reading Achievement as the criterion variable.

Multiple R: .4082 R^2: .1666 Significant F: .0000 N = 2,177

Step	Predictor Variables	B	Beta	Sig. t	R^2 Change
Block I					
1	PRESCHOL	.0803	.0144	.494	
2	PSHOME	.3827	.0668	.004	
					.0252
Block II					
3	RETARD	-.7644	-.1169	.000	
4	ELSCHOL	.2726	.0449	.035	
5	ELHOME	-.1701	-.0313	.186	
					.0582
Block III					
6	OPTIONAL	-.8549	-.1363	.000	
7	EXCEL	.5869	.1044	.000	
8	HSHOME	.3520	.0628	.008	
9	HISCHOL	1.0149	.1846	.000	
					.0833

Table 5. A summary of the regression coefficients and Multiple R within each gender and social class regression model.

	Regression Models				
Predictor Variables	Low SES Beta (n=1257)	Middle SES Beta (n=780)	High SES Beta (n=170)	Male Beta (n=1140)	Female Beta (n=1035)
PRESCHOL	.0219	-.0081	.0398	.0186	.0161
PSHOME	.0906	.0250	.0755	.1127	.0257
RETARD	-.1038	-.1302	-.1390	-.1368	-.1063
ELSCHOL	.0257	.0886	.0041	.0157	.0775
ELHOME	-.0286	-.0123	-.1475	-.0529	-.0050
OPTIONAL	-.1458	-.1353	-.0432	-.1354	-.1314
EXCEL	.0768	.1459	.0969	.0638	.1434
HSHOME	.0596	.0362	.1213	.0697	.0601
HISCHOL	.2034	.1818	.0229	.1692	.1953
Multiple R:	.4105	.4194	.2995	.3911	.4408